CLAIMS

I Claim:

1. In a flying object defined by an exterior skin and having a guidance computer and a body axis parallel with the length of the object, **A Dragless Flight Control System** for controlling the flight of the object while minimizing drag, said dragless control system comprising: at least one pair of first housing and second housing, said housings being recessed inside said flying object and each having an opening communicating with said exterior skin; at least one pair of first and second fins positioned inside said housings, respectively, said fins being exposable outside said exterior skin and being completely retractable into said housings through said openings, said first and second fins being mounted to rotate in opposite directions and further being rotatable by variable corrective angles; a means to determine said corrective angles; and a driving system for rotating said fins by said corrective angles such that varying portions of said fins protrude outside said skin through said opening, providing desired degree of control of said object's flight.
2. **A Dragless Flight Control System** as set forth in claim 1, wherein said means to determine said corrective angles comprises: a means for ascertaining current rotational position of said fins; and an electronic controller coupled between said ascertaining means and said guidance computer, said controller receiving current rotational position information from said ascertaining means and new positional command signal from said computer and, by comparing said information and said command signal, generating an error signal representative of a corrective angle, said controller then further producing a voltage command corresponding to said corrective angle, said voltage command being input to said driving

system to enable said driving system to vary the rotational positions of said fins by said corrective angle so as to eliminate said error signal.

3. **A Dragless Flight Control System** as set forth in claim 2, wherein each of said fins has a front end and a back end.
4. **A Dragless Flight Control System** as set forth in claim 3, wherein said first and second fins in their respective housings are positioned at a first pre-set angle relative to said body axis and are mounted to allow said fins to have rotation vectors normal to said exterior skin.
5. **A Dragless Flight Control System** as set forth in claim 4, wherein said driving system comprises: a drive motor coupled to said electronic controller to receive said voltage command and generate a corresponding torque; a rotating means coupled between said fins and said drive motor, said rotating means rotating said fins simultaneously but in opposite directions in response to said torque signal; and a means for delivering said torque from said motor to said rotating means.
6. **A Dragless Flight Control System** as set forth in claim 5, wherein said fins do not rotate beyond a second pre-set angle.
7. **A Dragless Flight Control System** as set forth in claim 6, wherein said first and second fins are positioned so as to present mirror image of each other with respect to said body axis.
8. **A Dragless Flight Control System** as set forth in claim 7, wherein said rotating means comprises: a motor drive gear; a motor transmission coupled between said drive motor and said motor drive gear to multiply said torque selectively prior to delivering said torque to said motor drive gear; a first fin gear shaft and a second fin gear shaft, said fin gear shafts being rotationally coupled to their respective fins so as to allow said fins to rotate; a first fin gear coupled between said first fin gear shaft and said motor drive gear to transmit said torque from said motor drive gear to said first fin gear shaft to enable said first fin gear shaft to rotate said first fin;

and a second fin gear coupled between said second fin gear shaft and said motor drive gear to transmit said torque from said motor drive gear to said second fin gear shaft to enable said second fin gear shaft to rotate said second fin, said first and second fins always rotating in opposite directions, thereby exposing one fin while retracting the other fin.

9. **A Dragless Flight Control System** as set forth in claim 8, wherein said rotating means further comprises two O-ring seals, each seal being coupled to one of said fin gear shafts inside its corresponding housing to render stability to said fin gear shaft.
10. **A Dragless Flight Control System** as set forth in claim 9, wherein said rotating means still further comprises a transmission shaft coupled between said motor transmission and said motor drive gear.
11. **A Dragless Flight Control System** as set forth in claim 10, wherein said means for ascertaining current rotational position of said fins is a hall sensor located in said drive motor, said sensor deriving said current rotational position by counting hall pulses generated by said motor.
12. **A Dragless Flight Control System** as set forth in claim 11, wherein said flight control system further comprises several pairs of said fins, said several pairs being deployed at regular intervals around the circumference of said flying object.
13. **A Dragless Flight Control System** as set forth in claim 12, wherein said fin gear shafts are positioned to be coupled to said front ends of their respective fins.
14. **A Dragless Flight Control System** as set forth in claim 13, wherein said fins are positioned with respect to each other such that said back ends are further apart than said front ends.
15. **A Dragless Flight Control System** as set forth in claim 13, wherein said fins are positioned with respect to each other such that said front ends are further apart than said back ends.

16. **A Dragless Flight Control System** as set forth in claim 6, wherein said first and second fins are positioned staggered with respect to each other.

17. **A Dragless Flight Control System** as set forth in claim 16, wherein rotating means comprises: a first motor drive gear; a second motor drive gear; a motor transmission coupled between said drive motor and said motor drive gears to multiply said torque selectively prior to delivering said torque to said motor drive gears; a first fin gear shaft and a second fin gear shaft, said fin gear shafts being rotationally coupled to their respective fins so as to allow said fins to rotate; a first fin gear coupled between said first fin gear shaft and said first motor drive gear to transmit said torque from said first motor drive gear to said first fin gear shaft to enable said first fin gear shaft to rotate said first fin; and a second fin gear coupled between said second fin gear shaft and said second motor drive gear to transmit said torque from said second motor drive gear to said second fin gear shaft to enable said second fin gear shaft to rotate said second fin, said first and second fins always rotating in opposite directions, thereby exposing said first fin while retracting said second fin.